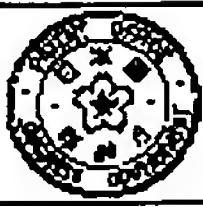


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PATENT ABSTRACTS OF JAPAN

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(71) Applicant: **MITSUBISHI HEAVY IND LTD**
(72) Inventor: **MORIGA TAKUYA**
HIRATA ISAO

(54) MANUFACTURE OF GAS DIFFUSION ELECTRODE

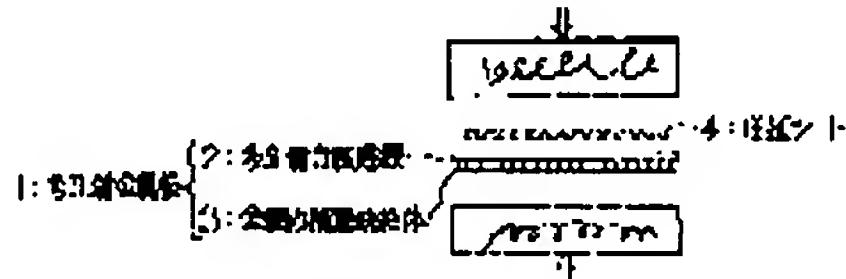
(57) Abstract:

PURPOSE: To provide a gas diffusion electrode having high gas diffusibility for a solid high polymer electrolyte fuel cell by using a porous metal plate to hot press a specific sheet-shaped reaction layer on a specific sheet-shaped gas diffusion layer.

CONSTITUTION: Water repellent carbon black is mixed with polytetrafluoroethylene and a carbon of graphite system, to add solvent naphtha and surface active agent rolled by a roll method, and a 6mm thick reserved molded gas diffusion layer sheet is obtained. Hydrophilic carbon black, water repellent carbon black and polytetrafluoroethylene are mixed further rolled by

a roll method by adding solvent naphtha, and a 0.3mm thick preliminary molded reaction layer sheet is prepared. Both the sheets are lamination rolled to 0.7mm thickness and heated to remove a surface active agent. This sheet 4 is superposed on a porous metal plate 1, formed of porous metal thin film 2 and metal mesh layer-built sintered body 2, and hot pressed to obtain a 0.65 to 0.7mm thick gas diffusion electrode.

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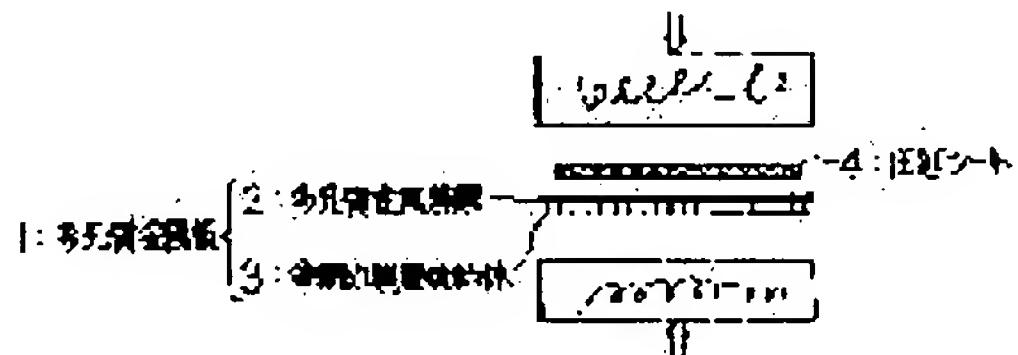
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CLAIMS

[Claim(s)]

[Claim 1] The manufacture approach of the gas diffusion electrode characterized by carrying out the hotpress of the reaction layer of the shape of a sheet which consists of hydrophilic carbon black, water-repellent carbon black, and polytetrafluoroethylene using a porosity metal plate on the gaseous diffusion layer of the shape of a sheet which comes to mix a carbon fiber in water-repellent carbon black and polytetrafluoroethylene.

[Claim 2] The manufacture approach of the gas diffusion electrode characterized by performing the hotpress process which is made to support the diffusion layer raw material powder which becomes a reverse field from water-repellent carbon black and polytetrafluoroethylene about

the reaction layer raw material powder which becomes one field of a porous carbon base material from hydrophilic carbon black, water-repellent carbon black, and polytetrafluoroethylene, and follows a cold pressing process and it after that using a porosity metal plate.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the manufacture approach of the gas diffusion electrode used for a solid-state polyelectrolyte mold fuel cell.

[0002]

[Description of the Prior Art] There are some which carried out the laminating of what blended and carried out rolling sheet forming of the solvent to the reaction layer raw material powder which consists of a hydrophilic property, and hydrophobic carbon black and polytetrafluoroethylene as a manufacturing method of the conventional gas diffusion electrode for solid-state polyelectrolyte mold fuel cells, and the thing which blended and carried out rolling sheet forming of the solvent naphtha to the diffusion layer raw material powder which consists of hydrophobic carbon black and polytetrafluoroethylene, rolled it out repeatedly further, and were fabricated in the shape of a sheet.

[0003]

[Problem(s) to be Solved by the Invention] The manufacturing method of the conventional gas diffusion electrode had the problem that add solvent naphtha to carbon black or a hydrophilic property and water-repellent carbon black, and the mixture of polytetrafluoroethylene as a solvent, and roll out repeatedly with a roll etc., gaseous diffusion nature falls as a result of crushing a gaseous diffusion path, in order to make it the shape of a sheet, and the engine

performance of a fuel cell fell.

[0004] then, in order to raise gaseous diffusion nature and to raise the engine performance of a fuel cell, on the other hand, this invention persons looked the reaction layer like [one side of a gas diffusion electrode (Japanese Patent Application No. No. 224218 / five to /), or a porous carbonaceous base material which made the carbon fiber mix into the gaseous diffusion layer which consists of water-repellent carbon black and polytetrafluoroethylene previously], and have proposed the gas diffusion electrode (Japanese Patent Application No. No. 203277 [four to]) which comes to support diffusion layer powder. In the press process of the production process of these gas diffusion electrodes, since gaseous diffusion nature was improved and many openings existed in a gas diffusion electrode, the gas diffusion electrode might carry out burst breakage by release of the air in the opening which the opening was compressed with a press and compressed at the time of press discharge, and the yield on manufacture was bad. [0005] This invention tends to offer the manufacture approach of the gas diffusion electrode for solid-state polyelectrolyte mold fuel cells which canceled the nonconformity generated at the conventional press process in view of the above-mentioned technical level.

[0006]

[Means for Solving the Problem] This invention is the manufacture approach of the gas diffusion electrode characterized by carrying out the hotpress of the reaction layer of the shape of a sheet which consists of hydrophilic carbon black, water-repellent carbon black, and polytetrafluoroethylene using a porosity metal plate on the gaseous diffusion layer of the shape of a sheet which comes to mix a carbon fiber in (1) water-repellence carbon black and polytetrafluoroethylene. (The 1st invention)

(2) The manufacture approach of the gas diffusion electrode characterized by performing the hotpress process which is made to support the diffusion layer raw material powder which becomes a reverse field from water-repellent carbon black and polytetrafluoroethylene about the reaction layer raw material powder which becomes one field of a porous carbon base material from hydrophilic carbon black, water-repellent carbon black, and polytetrafluoroethylene, and follows a cold pressing process and it after that using a porosity metal plate. It is (the 2nd invention).

[0007] The water-repellent carbon black as used in the field of this invention is a thing belonging to the classification of acetylene black. A rack (DENKI KAGAKU KOGYO K.K. make) is raised, and hydrophilic carbon black is a thing belonging to the classification of furnace black. as a typical thing -- DIN -- a turnip -- To the above-mentioned water-repellent carbon black, since there are many surface functional groups (- OH radical, -COOH radical = O etc. sets etc.) of carbon black, it has a hydrophilic property, and it is a typical thing. Vulcan XC72R (Cabot shrine make) is raised. However, the water repellence or the hydrophilic carbon black said to this invention is not limited to the thing of the above-mentioned representation.

[0008] As for the gaseous diffusion layer in the 1st invention of this invention, a rolling sheet shaping-top and a gas passageway are secured. and from when the path in which generation water clearance is possible is maintained It is preferably good 70 / 30 - 60/40, (water-repellent carbon black + polytetrafluoroethylene) / carbon fiber =90 / 10 - 50/50, and that it is 80 / 20 - 60/40 preferably. a weight ratio -- water-repellent carbon black / polytetrafluoroethylene =80 / 20 - 50/50 -- Therefore, it is good water-repellent carbon black / polytetrafluoroethylene / carbon fiber =70/18/10-25/25/50 and to be preferably referred to as 56/24/20-36/24/40 as the whole.

[0009] Moreover, the carbon fiber as used in the field of the 1st invention of this invention is called the chop or Mild who cut the raw thread of a carbon fiber, average die length is 0.1-5mm, the diameter of fiber is 10-20 micrometers, and it has two sorts, a carbon system and a graphite system, and are min99%, volume resistivity 10-2 - 10-3ohmcm carbon content min95wt%, respectively. A thing (average fiber-length:0.1-0.5mm and diameter:of fiber10-15micrometer) is preferably used by the graphite system.

[0010] A gas passageway when a catalyst is supported and the reaction layer as used in the field of the 1st invention of this invention and the 2nd invention has a hydrophilic part is secured. It is 70 / 30 - 50/50 preferably. and a weight ratio [from / when the water-repellent section and its path are secured so that generation water can be removed] -- hydrophilic carbon black / water-repellent carbon black =90 / 10 - 40/60 -- (Hydrophilic carbon black + water repellence carbon black) / polytetrafluoroethylene = it is good 90 / 10 - 50/50, and to be preferably referred to as 70 / 30 - 60/40.

[0011] as the water-repellent carbon black used by the 1st invention of this invention, and the 2nd invention, and hydrophilic carbon black -- mean-diameter:500A and diameter of structure: -- about 0.5-micrometer thing -- moreover, it is desirable to use a particle diameter:0.2-0.4micrometer thing as polytetrafluoroethylene.

[0012] As a porous carbon base material as used in the field of the 2nd invention of this invention ******(omegacm): -- 10-3 to 10-1 -- desirable -- 10-2 to 10-3, and average pore diameter (micrometer):1-200 -- desirable -- 30-150, and porosity (%):20-80 -- desirable -- 50-70, and thickness (mm):0.5-5 -- preferably 0.7-2 The carbon material to satisfy is used and porous carbon, carbon paper, carbon fiber textiles, etc. are raised as the example.

[0013] Moreover, in order to support the reaction layer raw material powder in the 2nd invention of this invention, and diffusion layer raw material powder to a porous carbon base material, it is made by sprinkling each raw material powder over a porous carbon base material through a screen.

[0014] A laminating and the tabular thing pressurized and sintered are raised from the upper layer to the metal nonwoven fabric bottom in two or more wire gauzes at which pore size becomes large gradually toward a lower layer preferably as a porosity metal plate used by the

1st invention of this invention, and the 2nd invention. In order to carry out the hotpress of the gas diffusion electrode, the smooth thing of the metal nonwoven fabric of a porosity metal plate 50 micrometers or less and whose numerical aperture pore size is 10 - 40% is desirable. Since the wire gauze of a porosity metal plate is a thing for reinforcement of a metal nonwoven fabric, what has the reinforcement which can be used as a porosity metal plate at a press process is used. Although the construction material of these metal nonwoven fabric and a wire gauze is not restrictive, either, austenitic stainless steel (SUS 304,304L and 316,316L etc.) and a nickel radical alloy system ingredient like Hastelloy are used.

[0015]

[Function] According to this invention, by using a porosity metal plate in the press process in a gas diffusion electrode production process, the air which exists in the opening in a gas diffusion electrode can be missed, and the burst of the gas diffusion electrode at the time of press discharge and breakage can be prevented.

[0016]

[Example] Hereafter, an example explains this invention concretely.

(Example 1) The structure of the porosity metal plate used in this example is shown in drawing 1. The above-mentioned porosity metal plate 1 uses the metal nonwoven fabric made from SUS304 as a porosity metal thin film 2. Two or more wire gauzes made from SUS304 from the upper layer so that pore size may become large gradually toward a lower layer at the bottom A laminating, the laminating sintered compact 3 of the tabular wire gauze pressurized and sintered -- it is -- this example -- as a metal nonwoven fabric -- 2micro BEKIPOA (a trade name --) The amount of eyes: From the upper layer, the wire gauze of 300 g/m² and reinforcement carries out the laminating of 200, 100, and the wire gauze of 40 or 40 meshes to the metal nonwoven fabric bottom, and carries out pressure sintering to it toward a lower layer, and magnitude is 2 300mm. The thing was used.

[0017] Mean diameter: To 420A water-repellent carbon black (DIN a turnip rack), by mean-diameter:0.3micrometer polytetrafluoroethylene and a graphite system, the carbon fiber (average Itonaga:0.13mm and diameter:of fiber13micrometer) was mixed at a rate of the weight ratio 50:40:20, solvent naphtha was mixed by the ratio of 1:1.6 to it, rolling shaping of what added the surfactant further was carried out by the rolling method, and the preforming gaseous diffusion layer sheet of 6mm thickness was obtained. Moreover, mean-diameter:400A hydrophilic carbon black (Valcan XC72R), mean-diameter:420A water-repellent carbon black (DIN a turnip rack), and a mean diameter: 0.3-micrometer polytetrafluoroethylene was mixed at a rate of the weight ratio 50:20:30, solvent naphtha was mixed at a rate of 1:1.8 to it, it rolled out by the rolling method, and the preforming reaction layer sheet of 0.3mm thickness was obtained. The laminating of the preforming gaseous diffusion layer sheet of this 6mm thickness and the preforming reaction layer sheet of 0.3mm thickness is carried out, and it rolls out to 0.7

moremm thickness by the rolling method, and is 2 the magnitude of 250mm. The rolling sheet was obtained.

[0018] Next, after heating and carrying out the desurfactant of the rolling sheet obtained by the above-mentioned approach in an electric furnace, the hotpress was carried out by 380 degree-Cx50 kg/cm² x3sec. with hotpress equipment as shows this rolling sheet to drawing 2 using the porosity metal plate 1 which consists of the porosity metal thin film 2 and the laminating sintered compact 3 of a wire gauze which were explained by drawing 1. In addition, in drawing 2, 4 shows the above-mentioned rolling sheet further rolled out with hotpress equipment. By this hotpress equipment, as shown in the after-mentioned table 1, the gas diffusion electrode of penetrable outstanding 0.65-0.7mm thickness was obtained without breakage.

[0019] (Example 1 of a comparison) With hotpress equipment as shows the rolling sheet 4 obtained in the example 1 to drawing 3, the gas diffusion electrode was obtained using the SUS sheet metal (or brass sheet metal) 5 of 10mm thickness. This gas diffusion electrode was inferior to gas permeability, as shown in the after-mentioned table 1.

[0020] Plain-weave 1K (K: the number of the filaments in a carbon fiber, K= 1000), (Example 2) Thickness: 0.5mm and eyes:220 g/m² Carbon fiber textiles are used as a base material. It is the same approach as an example 1. Mean-diameter:400A hydrophilic carbon black (Valcan XC72R), Mean diameter : 420A water-repellent carbon black (DIN a turnip rack), mean-diameter: -- the reaction layer raw material powder which carried out mixed desiccation of the 0.3-micrometer polytetrafluoroethylene at a rate of the weight ratio 35:35:30, and mean-diameter: -- 420A water-repellent carbon black (DIN a turnip rack) -- Mean diameter : The diffusion layer raw material powder which carried out mixed desiccation of the 0.3-micrometer polytetrafluoroethylene at a rate of the weight ratio 65:35 is pulverized with a mill, respectively. The screen of 100 meshes is minded [of stainless steel sheet metal] first, and it is diffusion layer raw material powder 150 g/m² It sprinkled uniformly at a rate, and carbon fiber textiles were piled up on it and reaction layer raw material powder was further sprinkled at a rate of 60 g/m² through the screen of 100 meshes on the textiles similarly.

[0021] Then, after carrying out cold forming (50kg/cm²) using the porosity metal plate explained in the example 1 and heating and carrying out a desurfactant in an electric furnace further, the outstanding gas diffusion electrode of gas permeability as shown in the after-mentioned table 1 without breakage was obtained by carrying out a hotpress (380 degree-Cx50 kg/cm² x3sec) using the same porosity metal plate.

[0022] (Example 2 of a comparison) When having carried out cold forming (50kg/cm²) after making both sides of the same carbon fiber textiles base material as an example 2 support the same reaction layer raw material powder as an example 2, and diffusion layer raw material powder and having been carried out using SUS sheet metal (1mm thickness) as shown in drawing 3, the raw material fine particles supported at the time of press discharge dispersed,

and manufacture of a gas diffusion electrode was impossible.

[0023]

[A table 1]

表 1
ガス透過試験結果
(差圧法: 0.5 kg/cm²、空気入口 100 ミリリットル/分)

	ガス透過量 (ミリリットル/分)
実施例 1 のガス拡散電極	35
実施例 2 のガス拡散電極	75
比較例 1 のガス拡散電極	18

[0024]

[Effect of the Invention] According to this invention, the gas diffusion electrode which has the high gaseous diffusion nature for solid-state polyelectrolyte mold fuel cells can be offered.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The cross section of the porosity metal plate used in case the gas diffusion electrode of this invention is manufactured.

[Drawing 2] Between the colds using the porosity metal plate in this invention approach, or approximate account drawing of a hotpress machine.

[Drawing 3] Between the colds in a conventional method, or approximate account drawing of a

hotpress machine.

[Translation done.]

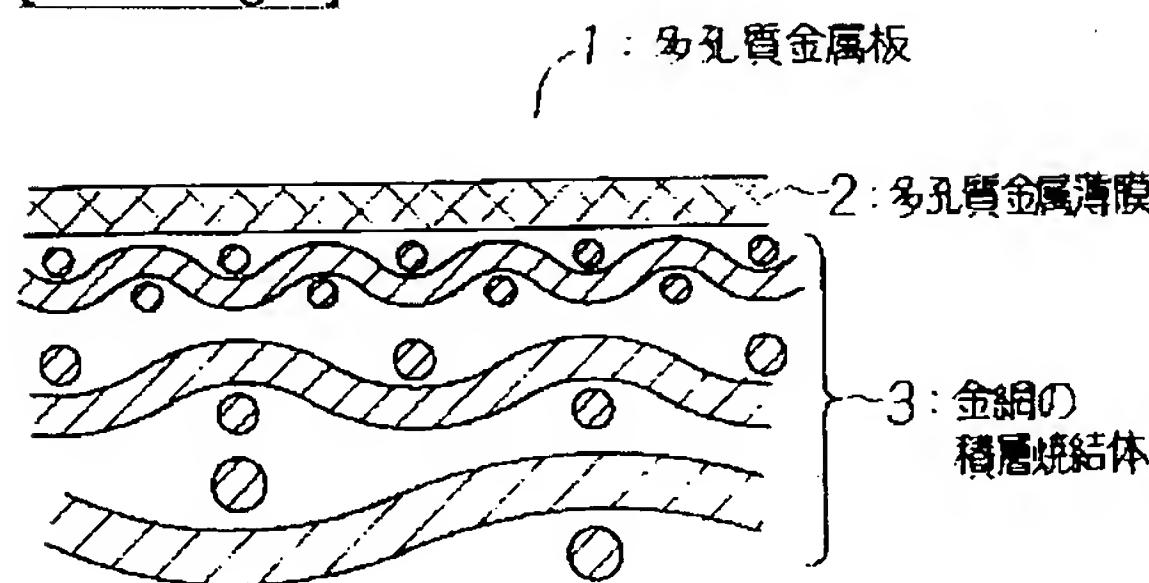
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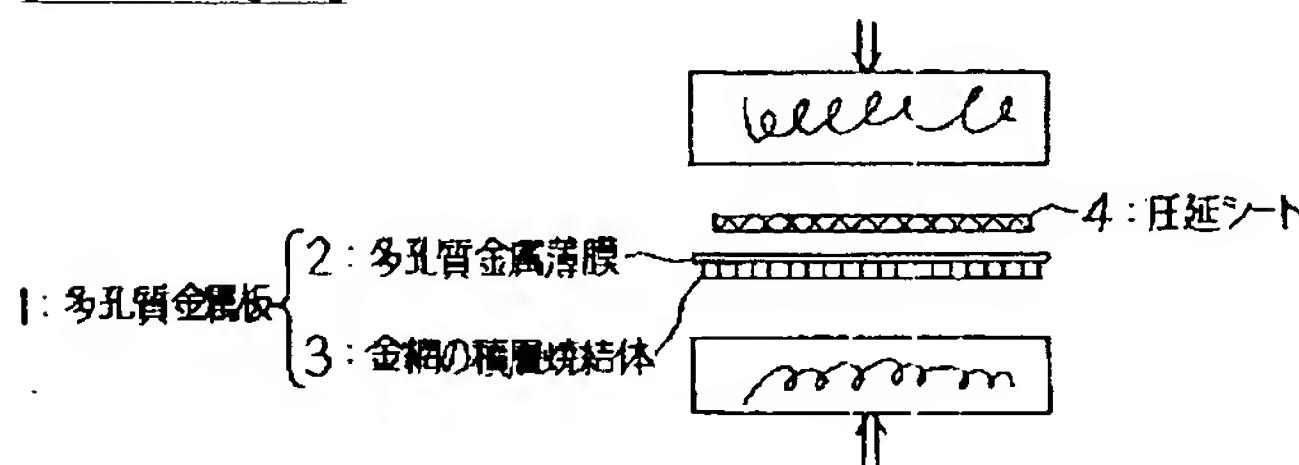
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DRAWINGS

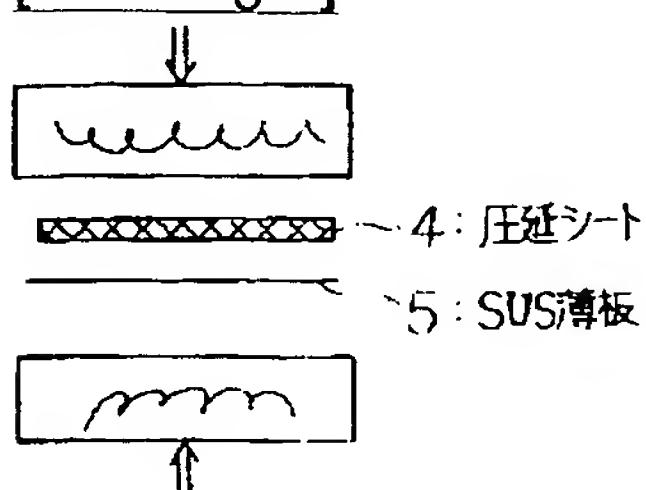
[Drawing 1]



[Drawing 2]



[Drawing 3]



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(54)【発明の名称】 ガス拡散電極の製造方法

(57)【要約】

【目的】 固体高分子電解質型燃料電池のガス拡散電極の製造方法に関する。

【構成】 ① 摻水性カーボンブラック、ポリ四フッ化エチレンに炭素繊維を混入してなるシート状のガス拡散層上に、親水性カーボンブラック、摻水性カーボンブラック及びポリ四フッ化エチレンからなるシート状の反応層を多孔質金属板を用いてホットプレスしてガス拡散電極を製造する方法及び② 多孔質炭素基材の一方の面に親水性カーボンブラック、摻水性カーボンブラック及びポリ四フッ化エチレンからなる反応層原料粉末を、反対の面に摻水性カーボンブラック、ポリ四フッ化エチレンからなる拡散層原料粉末を担持させ、その後冷間プレス工程及びそれに続くホットプレス工程を多孔質金属板を用いて行ってガス拡散電極を製造する方法。

【特許請求の範囲】

【請求項1】 摥水性カーボンブラック、ポリ四弗化エチレンに炭素繊維を混入してなるシート状のガス拡散層上に、親水性カーボンブラック、摥水性カーボンブラック及びポリ四弗化エチレンからなるシート状の反応層を多孔質金属板を用いてホットプレスすることを特徴とするガス拡散電極の製造方法。

【請求項2】 多孔質炭素基材の一方の面に親水性カーボンブラック、摥水性カーボンブラック及びポリ四弗化エチレンからなる反応層原料粉末を、反対の面に摥水性カーボンブラック、ポリ四弗化エチレンからなる拡散層原料粉末を担持させ、その後冷間プレス工程及びそれに続くホットプレス工程を多孔質金属板を用いて行なうこととするガス拡散電極の製造方法。

【発明の詳細な説明】

【0001】

【産業上の利用分野】 本発明は固体高分子電解質型燃料電池に用いるガス拡散電極の製造方法に関する。

【0002】

【従来の技術】 従来の固体高分子電解質型燃料電池用ガス拡散電極の製造法としては親水性及び疎水性のカーボンブラックとポリ四弗化エチレンよりなる反応層原料粉末にソルベントを配合して圧延シート成形したものと、疎水性カーボンブラックとポリ四弗化エチレンよりなる拡散層原料粉末にソルベントナフサを配合し圧延シート成形したものを積層し、更に繰返し圧延しシート状に成形したものがある。

【0003】

【発明が解決しようとする課題】 従来のガス拡散電極の製造法はカーボンブラック又は親水性及び摥水性のカーボンブラック、ポリ四弗化エチレンの混合物にソルベントナフサを溶剤として加え、ロールなどにより繰返し圧延し、シート状にするためガス拡散通路がつぶされる結果ガス拡散性が低下し、燃料電池の性能が低下するという問題があった。

【0004】 そこで、ガス拡散性を向上させ、燃料電池の性能を向上させるために本発明者らは先に摥水性カーボンブラックとポリ四弗化エチレンからなるガス拡散層中に炭素繊維を混入させたガス拡散電極（特願平5-224218号）や多孔性炭素質基材の片面に反応層を他面に拡散層粉末を担持してなるガス拡散電極（特願平4-203277号）等を提案している。これらのガス拡散電極の製造工程のプレス工程において、ガス拡散性を向上したためにガス拡散電極中に空隙が多く存在するために、プレスにより空隙が圧縮され、プレス解除時に圧縮された空隙中の空気の解放によりガス拡散電極が破裂損傷することがあり、製造上の歩留りが悪いものであった。

【0005】 本発明は上記技術水準に鑑み、従来のプレス工程で発生する不具合を解消した固体高分子電解質型

燃料電池用ガス拡散電極の製造方法を提供しようとするものである。

【0006】

【課題を解決するための手段】 本発明は

（1）摥水性カーボンブラック、ポリ四弗化エチレンに炭素繊維を混入してなるシート状のガス拡散層上に、親水性カーボンブラック、摥水性カーボンブラック及びポリ四弗化エチレンからなるシート状の反応層を多孔質金属板を用いてホットプレスすることを特徴とするガス拡散電極の製造方法。（第1発明）

（2）多孔質炭素基材の一方の面に親水性カーボンブラック、摥水性カーボンブラック及びポリ四弗化エチレンからなる反応層原料粉末を、反対の面に摥水性カーボンブラック、ポリ四弗化エチレンからなる拡散層原料粉末を担持させ、その後冷間プレス工程及びそれに続くホットプレス工程を多孔質金属板を用いて行なうことを特徴とするガス拡散電極の製造方法。（第2発明）である。

【0007】 本発明でいう摥水性カーボンブラックとはアセチレンブラックという分類に属するもので、代表的なものとしてはデンカブラック（電気化学工業株式会社製）があげられ、親水性カーボンブラックとはファーネスブラックという分類に属するもので、上記摥水性カーボンブラックに対して、カーボンブラックの表面官能基（-OH基、-COOH基、=O基など）が多いため親水性を有するものであって、代表的なものとしてはVulcan XC 72 R（Cabot 社製）があげられる。しかしながら、本発明にいう摥水性又は親水性カーボンブラックは上記代表のものに限定されるものではない。

【0008】 本発明の第1発明におけるガス拡散層は圧延シートの成形上及びガス通路が確保され、かつ生成水除去が可能な通路が保たれる上から、重量比で摥水性カーボンブラック／ポリ四弗化エチレン=80/20~50/50、好ましくは70/30~60/40、（摥水性カーボンブラック+ポリ四弗化エチレン）／炭素繊維=90/10~50/50、好ましくは80/20~60/40であるのがよく、したがって全体としては摥水性カーボンブラック／ポリ四弗化エチレン／炭素繊維=70/18/10~25/25/50、好ましくは56/24/20~36/24/40とするのがよい。

【0009】 また、本発明の第1発明でいう炭素繊維とは炭素繊維の原糸をカットしたチョップ又はミルドと呼ばれるもので、平均長さは0.1~5mm、繊維径は1.0~2.0μmであり、炭素系と黒鉛系の2種があり、それぞれ炭素含有率min 95wt%、min 99%、体積固有抵抗 10^{-2} ~ 10^{-3} Ω cmである。好ましくは黒鉛系で平均繊維長さ：0.1~0.5mm、繊維径：1.0~1.5μmのものが使用される。

【0010】 本発明の第1発明、第2発明でいう反応層は触媒が担持され親水部を有する上及びガス通路が確保され、かつ生成水が除去できるように摥水部やその通路

が確保される上から、重量比で親水性カーボンブラック／撥水性カーボンブラック=90/10~40/60、好ましくは70/30~50/50で、(親水性カーボンブラック+撥水性カーボンブラック)／ポリ四弗化エチレン=90/10~50/50、好ましくは70/30~60/40とするのがよい。

【0011】本発明の第1発明、第2発明で使用する撥水性カーボンブラック及び親水性カーボンブラックとしては平均粒径:500Å、ストラクチャー径:約0.5μmのものを、またポリ四弗化エチレンとしては粒子径:0.2~0.4μmのものを使用することが好ましい。

【0012】本発明の第2発明でいう多孔質炭素基材としては体積固有抵抗(Ωcm):10⁻³~10⁻¹、好ましくは10⁻²~10⁻³、平均気孔径(μm):1~200、好ましくは30~150、気孔率(%):20~80、好ましくは50~70、厚み(mm):0.5~5、好ましくは0.7~2を満足するカーボン材が用いられ、その例としてはポーラスカーボン、カーボンベーパー、炭素繊維織物などがあげられる。

【0013】また、本発明の第2発明における反応層原料粉末、拡散層原料粉末を多孔質炭素基材に担持するには、それぞれの原料粉末をふるいを介して多孔質炭素基材にふりかけることによってなされる。

【0014】本発明の第1発明、第2発明で用いる多孔質金属板としては好ましくは金属不織布の下側に、上層から下層に向って細孔径が徐々に大きくなるよう複数枚の金網を積層、加圧、焼結した板状のものがあげられる。ガス拡散電極をホットプレスするために、多孔質金属板の金属不織布は細孔径が50μm以下、開口率が10~40%の平滑なものが好ましい。多孔質金属板の金網は金属不織布を補強のためのものであるのでプレス工程で多孔質金属板として使用しうる強度を有するようなものが使用される。これら金属不織布、金網の材質も限定的なものではないが、オーステナイト系ステンレス鋼(SUS304, 304L, 316, 316Lなど)、ハステロイのようなニッケル基合金系材料が用いられる。

【0015】

【作用】本発明によれば、ガス拡散電極製造工程中のプレス工程においては多孔質金属板を用いることにより、ガス拡散電極中の空隙に存在する空気を逃がし、プレス解除時におけるガス拡散電極の破裂、損傷を防ぐことができる。

【0016】

【実施例】以下、実施例により本発明を具体的に説明する。

(実施例1) この実施例で用いる多孔質金属板の構造を図1に示す。上記多孔質金属板1は多孔質金属薄膜2としてSUS304製の金属不織布を用い、その下側に上

層から下層へ向って細孔径が徐々に大きくなるよう複数枚のSUS304製の金網を積層、加圧、焼結した板状の金網の積層焼結体3であり、この実施例では金属不織布として2μベキボア(商品名、目付量:300g/m²)、補強の金網は金属不織布の下側に上層から下層へ向って200、100、40、40メッシュの金網を積層し加圧焼結したものであり、大きさは300mm²のものを用いた。

【0017】平均粒径:420Åの撥水性カーボンブラック(デンカブラック)に、平均粒径:0.3μmのポリ四弗化エチレン及び黒鉛系で平均糸長:0.13mm、繊維径:13μmの炭素繊維を、重量比50:40:20の割合で混合し、それにソルベントナフサを1:1.6の比率で混合し、さらに界面活性剤を添加したものをロール法で圧延成形し、6mm厚の予備成形ガス拡散層シートを得た。また、平均粒径:400Åの親水性カーボンブラック(Valcan XC72R)と平均粒径:420Åの撥水性カーボンブラック(デンカブラック)と平均粒径:0.3μmのポリ四弗化エチレンを重量比50:20:30の割合で混合し、それにソルベントナフサを1:1.8の割合で混合してロール法により圧延し、0.3mm厚の予備成形反応層シートを得た。この6mm厚の予備成形ガス拡散層シートと0.3mm厚の予備成形反応層シートを積層し、ロール法により更に0.7mm厚まで圧延し、大きさ250mm²の圧延シートを得た。

【0018】次に、上記方法で得た圧延シートを電気炉中で加熱して脱界面活性剤した後、該圧延シートを図1で説明した多孔質金属薄膜2と金網の積層焼結体3よりなる多孔質金属板1を用いて、図2に示すようなホットプレス装置で380°C×50kg/cm²×3sec.でホットプレスした。なお、図2において、4はホットプレス装置で更に圧延される上記の圧延シートを示す。このホットプレス装置によって、後記表1に示すように損傷なく透過性の優れた0.65~0.7mm厚のガス拡散電極が得られた。

【0019】(比較例1)実施例1で得られた圧延シート4を図3に示すようなホットプレス装置によって、10mm厚のSUS薄板(又は真ちゅう薄板)5を用いてガス拡散電極を得た。このガス拡散電極は後記表1に示すようにガス透過性に劣ったものであった。

【0020】(実施例2)平織り1K(K:炭素繊維中のフィラメントの数、K=1000)、厚み:0.5mm、目付:220g/m²の炭素繊維織物を基材とし、実施例1と同様な方法で平均粒径:400Åの親水性カーボンブラック(Valcan XC72R)、平均粒径:420Åの撥水性カーボンブラック(デンカブラック)、平均粒径:0.3μmのポリ四弗化エチレンを重量比35:35:30の割合で混合乾燥した反応層原料粉末及び平均粒径:420Åの撥水性カーボンブラック(デン

5

カブラック)、平均粒径: 0.3 μm のポリ四弗化工チレンを重量比 6.5 : 3.5 の割合で混合乾燥した拡散層原料粉末をそれぞれミルで微粉碎し、先ずステンレス薄板の表面に 100 メッシュの篩を介して拡散層原料粉末を 150 g/m^2 の割合で均等にふりかけ、その上に炭素繊維織物を重ね、更にその織物の上に、同様に 100 メッシュの篩を介して反応層原料粉末を 60 g/m^2 の割合でふりかけた。

【0021】その後、実施例 1 で説明した多孔質金属板を用いて冷間成形 (50 kg/cm^2) し、さらに電気炉中で加熱して脱界面活性剤した後、同様な多孔質金属板を用いてホットプレス ($380^\circ\text{C} \times 50 \text{ kg/cm}^2$ *)

表 1

ガス透過試験結果

(差圧法: 0.5 kg/cm^2 、空気入口 100 ミリリットル/分)

	ガス透過量 (ミリリットル/分)
実施例 1 のガス拡散電極	35
実施例 2 のガス拡散電極	75
比較例 1 のガス拡散電極	18

【0024】

【発明の効果】本発明によれば、固体高分子電解質型燃料電池用の高いガス拡散性を有するガス拡散電極を提供することができる。

【図面の簡単な説明】

【図 1】本発明のガス拡散電極を製造する際に用いられ 30

* $\times 3 \text{ sec}$ することによって損傷なく後記表 1 に示すようなガス透過性の優れたガス拡散電極を得た。

【0022】(比較例 2) 実施例 2 と同じ炭素繊維織物基材の両面に、実施例 2 と同じ反応層原料粉末、拡散層原料粉末を担持させた後、冷間成形 (50 kg/cm^2) する際に、図 3 に示すような SUS 薄板 (1 mm 厚) を用いて行ったところ、プレス解除時に担持した原料粉体が飛散し、ガス拡散電極の製造は不可能であった。

10 【0023】

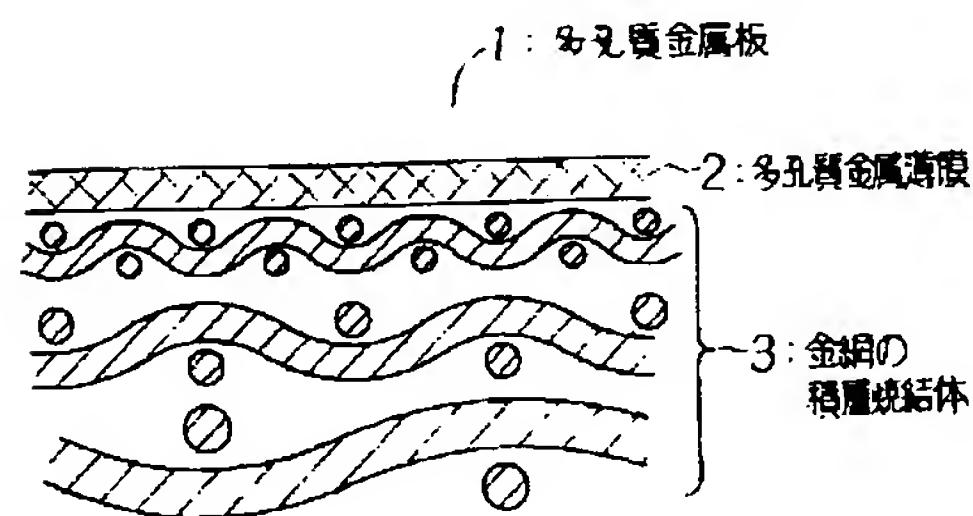
【表 1】

る多孔質金属板の断面模式図。

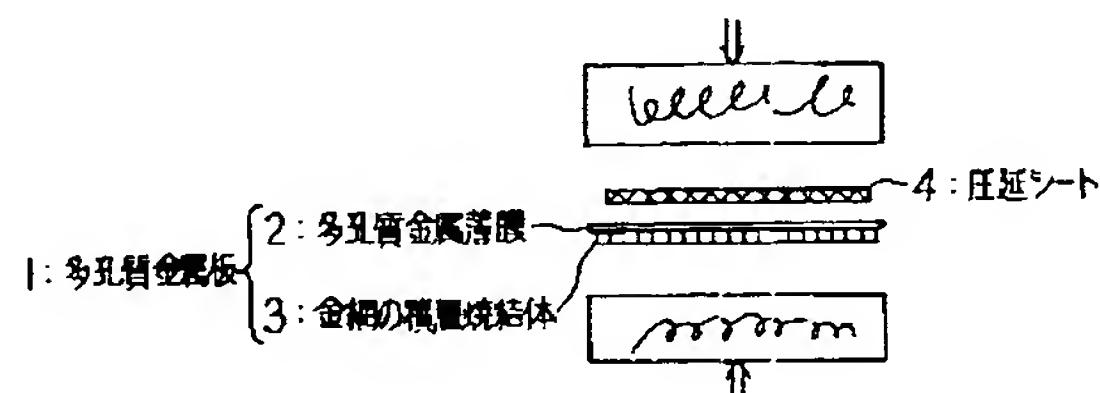
【図 2】本発明方法における多孔質金属板を用いる冷間又はホットプレス機の概略説明図。

【図 3】従来法における冷間又はホットプレス機の概略説明図。

【図 1】



【図 2】



【図 3】

